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ABSTRACT

This study evaluates the readability levels of frequently used literacy materials, the power builder component of the SRA Reading Laboratory IIIB. A review of the readability literature reveals numerous studies performed on content area textbooks but relatively few studies performed on literacy materials. Three questions are asked: (1) What is the Dale-Chall readability level of each power builder? (2) What is the average Dale-Chall readability level of each color level? and (3) Do the Dale-Chall readability levels for each color level correspond to the readability levels asserted by the publisher? A computer analysis of the power builders indicates that: (1) readability scores for individual power builders range from grade 4.0 to grade 14.0; (2) the average readability score for each level ranges from grade 5.8 to grade 12.2; and (3) the average Dale-Chall readability score for all levels is .2 to 1.4 years higher than the publisher-determined grade level. It was discovered that the readability scores in any one level cover a wide range. The smallest range occurs in purple--3.4 years, while the largest range occurs in aqua--6.5 years. Recommendations are made for application of the research findings and the revision of the Dale-Chall formula. (Author/MKM)

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CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

READABILITY ANALYSIS OF SRA POWER BUILDERS

An Examination of the Readability Levels
of the Power Builder Component of the
SRA Reading Laboratory IIIB as Measured
by the Dale-Chall Readability Formula

A thesis submitted in partial satisfaction of the
requirements for the degree of Master of Arts in

Secondary Education
with a Specialization in
Reading Improvement

by

Ellen Unell Rosen

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A computer analysis of the power builders indicates that a) readability scores for individual power builders range from grade

4.0 to grade 14.0; b) the average readability score for each level ranges from grade 5.8 to grade 12.2; and c) the average Dale-Chall readability score for all levels is .2 to 1.4 years higher than the publisher-determined grade level. Recommendations are made for application of the research findings and the revision of the Dale-Chall formula.

Chapter I: THE PROBLEM

Introduction and Background

A prime concept in modern education is individualization. Teachers are charged with the responsibility of finding suitable and understandable materials for each student or group of students. Teachers are held accountable for what they teach, yet often find themselves misled by inaccurate advertising claims of publishing companies. Mills and Richardson (1963), Bryant (1972), and Feinberg (1973) determined that some publishers do not submit texts to readability analyses, some make false claims concerning the difficulty of the texts, and some do not reveal the criterion upon which readability levels are determined.

This concept is particularly important in an era when an estimated three million or more students cannot read their literature texts (Aukerman, 1965). Kempfer (1950) declared a need for reading materials to be written at or below sixth grade level because nearly one-half of all adults had not gone beyond ninth grade schooling. Dale (1949), in his work for the National Tuberculosis Association, was confronted with the necessity of making information pamphlets readable because so many people were of limited education. He found that materials could be written at a seventh grade level and be understood by limited education readers as well as by good readers.

Statement of Problem

Chall (1955) acknowledged that teacher judgment of difficulty corresponded fairly well with tested difficulty. Despite such

judgments, Chall asserted, many children were given material that was too difficult for them to read and understand--the result, Chall felt, of publisher underestimates of the difficulty of the material designed for given ages and grade levels. Feinberg (1973) pointed out that with the abundance of materials available at any given level or subject, teachers must rely on the advertising claims of publishing companies, which frequently do not reveal the criteria upon which grade levels are determined. Mills and Richardson (1963) surveyed twelve publishing companies and asked about the use of grade levels and readability formulas. They found it significant that five out of the twelve companies did not reply. Of the seven responding, approximately half were annoyed that the researchers should infer the need for readability analyses. The remainder acknowledged the use of the author's or an educational consultant's opinion. Eleven years later, this practice continues: in a private communication (July 9, 1974), George Paterson, senior editor of Science Research Associates, stated that the editors of Science Research Associates

> employ a formulaic measure [similar in kind to the Fry, Flesch, Spache, or Dale-Chall formulas] to establish an overall objective framework for each color level, and within that framework they manipulate judgmental matters that will further suit the materials to the experience, maturity, and linguistic sophistication of the intended audience.

Rationale

Although many studies have been performed on content area textbooks (Cline, 1972, 1973; Cox, 1971; Fields, 1973; Simmons & Cox, 1972), few have been performed in the literacy area.

Rakes (1972, 1973a, 1973b) applied several readability formulas to materials used in adult basic education classes and found inconsistencies among the readability estimates, teacher judgments, and publisher estimates.

Purpose

The purpose of this study is to evaluate the readability levels of frequently used literacy materials, specifically the power builder component of the SRA Reading Laboratory IIIB (Science Research Associates, 1963).

Questions to be Answered

This study will answer the following questions:

1) What is the Dale-Chall readability level of each power builder in the SRA Reading Laboratory IIIB?
2) What is the average Dale-Chall readability level of each color level within the SRA Reading Laboratory IIIB?
3) Do the Dale-Chall readability levels for each color level correspond to the readability levels asserted by the publisher?

Assumptions

For the purpose of this survey, the following elements are assumed present in the SRA Reading Laboratory being studied: a) a sufficient and appropriate level of interest and appeal; b) appropriate and sequentially organized comprehension and vocabulary skills; and c) appropriate and sequentially organized rate, listening, and notetaking skills. Finally, the success of the SRA

Reading Laboratory in teaching the purported skills is not in question.

Definitions

Assigned grade level, grade level: the level of school at which a text or material is used, usually based upon publisher recommendation.

Color level: a grouping of several power builders with the same publisher-determined grade level and identified by a specified color.

Literacy materials: those materials used to teach reading skills, as distinguished from those materials written or designed to impart information in a content area.

Readability: the relative ease or difficulty with which a particular piece of writing may be understood or comprehended.

Readability formula: a regression formula, based on the counting and weighting of the most significant elements in predicting readability, which gives an objective measure of the difficulty of a writing sample.

Readability level: a grade level equivalent of a passage of writing, derived from a readability formula, which predicts the relative ease or difficulty of the passage. Thus, a passage with eighth grade readability indicates that the majority of students in eighth grade would have minimum difficulty in understanding or comprehending the passage, as measured by some form of post-test.

Limitations

The readability levels determined in this study are derived from the Dale-Chall readability formula (Dale & Chall, 1948a). Use of other formulas, particularly those based primarily on sentence length or syllable count, might produce different readability scores. Further, the Dale-Chall readability scores derived for the power builders in the SRA Reading Laboratory IIIB cannot be generalized to other components of the Reading Laboratory kits, to other SRA materials, or to any other literacy materials.

Outline

Chapter II will survey literature related to the study of readability. Chapter III will discuss methodology. Chapter IV will present the findings of this survey. Chapter V will then discuss these findings.

Chapter II: REVIEW OF THE LITERATURE

Since the development of the first readability measures, much literature has been written in the area of readability. This chapter summarizes the development of the Dale-Chall formula, the criticisms of readability formulas, recent developments in readability study, readability studies in education, and readability studies in related areas.

Development of the Dale-Chall Formula

Dale and Chall (1949) defined readability as

> the sum total (including the interactions) of all those elements within a given piece of printed material that affects the success a group of readers have with it. The success is the extent to which they understand it, read it at an optimum speed, and find it interesting [p. 23].

The idea behind readability is to match the reader with the printed material (Chall, 1955, 1958). The Dale-Chall formula (Dale & Chall, 1948a, 1948b), the tool used in this study, is said to be one of the best readability formulas available (Chall, 1958; Klare, 1952, 1963; Koenke, 1971; Nyman, Kearl & Powers, 1961; Powers, Sumner & Kearl, 1958). Several attempts, however, have been made to improve it, and Chall (1956) surveyed users and solicited their suggestions for improving the formula.

Several tables have been developed to shorten the time required for arithmetic computation (Klare, 1952; Koenke, 1971; R. J. Williams, 1972). Goltz (1964) offered evidence that holding constant the number of words in sample passages would afford quicker calculation with .99 correlation between the constant

number method and the original word count method. Martin and Lee (1961) found that samples taken at 50 page intervals yielded a grade placement as dependable as those taken at 10 page intervals. Nyman, et al. (1961) attempted to shorten the Dale list to include only those words appearing on both the Dale list and the Thorndike-Lorge AA group (the 1037 most frequently used words). However, using this list of 920 words resulted in loss of precision and predictive power.

Another problem has been the datedness of the vocabulary. The Dale-Chall formula was built upon the 1926 edition of the McCall-Crabbs Standard Test Lessons in Reading, material which Dale and Chall (1948a) admitted had deficiencies but was the best available at the time. The McCall-Crabbs tests were revised in 1950 and Powers, et al. (1958) revised the Dale-Chall to reflect the changes in the language and population. Although the formula coefficients in the revision have the same statistical validity as those calculated in the original formula, the authors offered the newer formula with some reservations.

Efforts have been made to revise the Dale list. Holmquist (1968a, 1968b) added a fourth grade science vocabulary of approximately 100 words and again calculated the formula, this time on the 1961 version of the McCall-Crabbs tests; formula coefficients were similar in statistical validity to those calculated in the original formula. Brown (1965) added words appearing in elementary science texts to the Dale list and found that the readability levels were lower using the updated list. He concluded that the probable reason the

Dale-Chall consistently ranked books higher than the actual level was because of the abundance of technical or new terms absent from the Dale list but present in science textbooks. Stocker (1968, 1971-72) offered an additional list of about 200 words commonly known by fourth graders educated for three or more years in Catholic schools.

In a related study, Babcock (1971) attempted to determine whether figurative language affected the readability of a literary passage. She found that the number of figures of speech did not affect readability or readers' comprehension.

Criticisms of Readability Formulas

Given the need to assess the difficulty of printed material, one may ask whether a readability formula is the best method of such assessment. Indeed, readability formulas have been criticized on several counts.

Neglect of Reader's Contribution

Feinberg (1973), asking on the one hand for an assessment of publisher claims, acknowledged that formulas do not consider the interests, backgrounds, abilities, or needs of the reader. Dale and Chall (1949) realized that success in reading depends on the reader--his reading skill, intelligence, experience, maturity, interest, and purpose in reading--as well as on the suitability of material. Klare (1963, 1973) pointed out that language factors (word frequency, word length, sentence length, redundancy) interact with human factors (recognition, speed, educational level, special reading experience, memory span, learning set, motivation),

which in turn interact with reading behaviors (reading efficiency, judgment of difficulty or acceptability, comprehension, learning, retention). He concluded that one must specify when and under what conditions readability measure is likely to be predictive; that is, the importance of a readability level may vary with the reader's level of motivation and competency as a reader.

Neglect of Syntactic Elements

Linguists have recently criticized readability formulas for neglecting to evaluate syntactic elements. Bormuth (1966, 1968, 1969) pointed out that readability formulas showed little understanding of the nature of language and neglected to account for grammatical structures. Von Glasersfeld (1970-1971) said that studies based on traditional or generative grammars do not account for some factors making the reading process difficult. Botel and Granowsky (1972) and Granowsky (1973) pointed out that syntactic elements other than sentence length must be evaluated: the use of such elements as passive voice, coordinating clauses, dependent clauses, participles, and deletions.

Neglect of Contextual Difficulty

Readability formulas have been criticized for neglecting contextual difficulty; abstractness, density, and interrelationship of ideas; and organization of material (Blair, 1971; Chall, 1955, 1956; Dale & Chall, 1955; Geyer, 1970; Glazer, 1974; Klare, 1973; Wall, 1969). Allbaugh (1968) attempted to determine whether fact burden, as conceived by Dolch, would predict comprehension success. She found that at each of three levels of difficulty,

readers performed better on medium-fact level passages. She therefore concluded that prediction of comprehension could be improved if the fact burden is controlled, and that at a given level of difficulty, too few or too many facts are detrimental to comprehension. Rosenshine (1968), while acknowledging the success of vertical studies (those studies representing a range of difficulty), pointed out the need for horizontal studies (those studies which distinguish between the effectiveness of essentially similar passages). He cited five variables of effectiveness: a) vagueness, b) explanatory links indicating relationships, c) frequency of examples, d) use of the rule-example-rule pattern, and e) irrelevancy.

Recent Developments in Readability Study

Recent dissatisfaction with readability measurement based on regression formulas has led to the development of two new methods of determining readability: the cloze method and the Syntactic Complexity Formula. Studies have also been made to determine the efficacy of rewriting passages according to the principles of readability.

The Cloze Method and the Syntactic Complexity Formula

From linguistic criticisms emerged two alternative forms of assessing readability levels: the cloze method (Bormuth, 1966, 1968) and the Syntactic Complexity Formula (Botel & Granowsky, 1972). In the cloze method, students fill in words deleted from every Nth position; the percentage of correct responses corresponds

to a level of difficulty. The Syntactic Complexity Formula, based on transformational-generative grammar theory, gives weight to different sentence structures; the average count corresponds to a difficulty level.

However, using cloze procedures, Guthrie (1970, 1972) and Van Vliet (1971) found that traditional readability formulas, such as the Dale-Chall, can be used to estimate learnability, or the extent to which a passage conveys new information, as well as readability. Guthrie (1972) concluded that materials with easy readability will likely impart a substantial amount of new learning to students. Geyer and Carey (1972) found that the Dale-Chall, the Flesch, and cloze methods ranked passages in the same order of difficulty. Hittelman (1973) pointed out that deleting every Nth word might not produce comparable tests for comparing passages, and that there is some evidence that structure words may be easier to produce than content words. He further contended that although some transformations are more readable than others, not all meaning is carried by sentence structure, and semantic and stylistic factors need consideration.

Rewriting Passages According to Readability Principles

Pauk (1973) suggested rewriting articles of known interest level to a desired level of readability. R. J. Williams (1968) and McTaggart (1964) conducted studies in which students understood passages rewritten to a lower level better than they understood the original passage. Drake (1967) and Marshall (1962), however, found results contradicting those of Williams and McTaggart.

Dale and Chall (1955) cited studies in which increased readability improved readership, comprehension, and retention. However, Dale (1949) also pointed out that simplification involved more than just shortening sentences or using easier words and offered specific suggestions for reinterpreting, amplifying, and reducing concepts. Grace (1963) compared the readability of written and programmed material; he found that programmed material had shorter words, fewer syllables, more familiar words, and more repeated words, and concluded that programmed subject matter was therefore simpler and less of an intellectual burden. Swarts (1954), studying books for teachers about reading, found that simplifying a technical book too much seemed to decrease the amount of technical information expected. Dronberger (1974), studying Research in Education abstracts, found that the abstracts were less readable than the source documents. Finkelstein (1959) presented in his dissertation a methodology for creating readable and interesting social studies text materials, and a sample textbook illustrative of the techniques proposed.

Readability Studies in Education

Despite controversy, numerous readability studies have been performed, most of which support charges of inaccurate manufacturer claims.

Social Sciences

Using the Spache formula and Fry graph on 37 primary level social studies textbooks, Johnson and Vardian (1973) found 2

measurements lower than the publisher estimates and 41 measures at least one grade level higher than publisher estimates; 11 of the books measured higher on both formulas. In the same study, using the Dale-Chall, the Fry, and the Flesch on 31 social studies texts in grades 4-6 (a yield of 93 measurements), only one measurement was lower than the publisher estimates, but 12 books were rated at least one year above grade level by all three formulas. Du Vall (1971), examining social studies texts for grades 4-6 adopted by the Indiana State Board of Education, found that no text had progressive difficulty, and there was a wide range of levels within each text. Sloan (1959), studying 21 social studies texts in grades 4-6, found that 11 texts had readability placements generally corresponding to publisher estimates, 10 had introductory material with readability placements at the level for which the texts were prepared, and 8 had content readability suitable for the grade level on which they were used; he concluded that in most texts he studied, the majority of readability scores were not concentrated at the level to which the book was assigned and that scores in each text were distributed over a wide range. Dohrman (1973), studying 600 social studies articles for grades 4-6 in 8 encyclopedias, found that 95 per cent of the articles studied were suitable for the upper reading levels of grades 4-6, and that only 5 per cent were suitable for the below average reading levels of those same grades. She concluded that none of the encyclopedias provided adequate collateral materials for all reading levels. Michaelis and Tyler (1951), attempting to determine the readability of United Nations material used in social studies classes, found that United Nations

materials were too difficult for the secondary students. Witherington (1952), studying eight educational psychology texts, found a readability range of grades 10-12, with an average of grade 11. He concluded that the readability level was appropriate for those students who enroll in the course for which the texts were assigned.

Language Arts

Using the Powers-Sumner-Kearl 1958 recalculation of the Dale-Chall, Roe (1969a, 1969b) found that 50 per cent of language arts textbooks for grades 4-6 were given appropriate grade levels by publishers, 33 per cent were rated too easy by publishers, and 16 per cent were rated too difficult by publishers. All but 4 of the 12 texts had some sections too hard for the assigned grade level, all had several grade levels in one text, one had easy-to-hard progression of difficulty, and two had hard-to-easy progression. In studying grammar texts, Cox (1971) found the transformational-generative texts too difficult for students' reading abilities, and Simmons and Cox (1972) found transformational-generative texts more difficult than the traditional Latinate grammar texts these newer texts replaced.

Reading

Bradley (1974), studying the Harper and MacMillan reading series, found a) that five readability measures each recorded a given book differently, b) that publisher estimates differed from the readability formula estimates, and c) that each book had intra-book variability. He also found that books in a series did not

necessarily progress from easy to difficult, that the reader and workbook readabilities did not always match, and that the instructional placement in each series differed. Rakes (1972, 1973a, 1973b), analyzing 29 materials used in adult basic education, found inconsistencies among readability estimates, teacher judgments, and publisher estimates. He suggested (1973b) that publisher attempts to control the difficulty of levels of the SRA Reading Laboratory IIIA may be inadequate because of the differences among formula indices, a particularly important problem since kit materials are based on sequential gradation.

Science

Gilbert (1972, 1973) studied each book in 10 basic science series and found that the averages of the four formulas used (Spache, Dale-Chall, Lorge, Fry) tended to be consistent with the mean reading level of that grade. He attributed any discrepancy between the readability level of the text and the grade level in which it was used to the introduction of science terminology and sentence structure. Belden and Lee (1961) found that only one of the five biology texts they studied had a readability score making it useful to over one-half of the students enrolled in biology. They (Belden & Lee, 1962) also found that out of five chemistry texts studied, the most difficult was useful only to 34 per cent of the students studied, the easiest to only 47 per cent, and that the Dale-Chall indice was one to two grade levels higher than the grade level at which chemistry was offered.

Mathematics

Heddens and Smith (1964) found that the readability of elementary mathematics textbooks was higher than publisher estimates. In a similar study (Smith & Heddens, 1964), they found that the readability level of experimental mathematics materials was higher than the assigned grade level and apparently higher than student ability. Belden and Lee (1962) found that out of five physics texts studied, the hardest was useful to 62 per cent of the students, the easiest to 90 per cent, and that four of the five texts studied had readability scores below the usual twelfth grade placement. Kulm (1973), however, pointed out the need to sample prose and symbol material separately and to use separate formulas suitable for each type of material. His study showed that what makes mathematics material hard to read is different from what makes English and prose difficult to read; that is, it is not the vocabulary but the difficulty of the symbolism of mathematics.

Industrial Arts

McKell (1971) found significant differences between the average reading ability of students in trade and industrial arts education and the readability of the basic texts. Miller (1960, 1961, 1962) studied five industrial arts texts and found four of them too difficult for the majority of ninth grade industrial arts students to read them effectively; although the texts ranged in readability levels from grade 8 to grade 10, each text had a readability spread from 7 to 11 grade levels, and 70 per cent of ninth grade students were

below ninth grade level in reading ability.

Vocational Education

Bentley and Galloway (1961) found that each of the vocational agriculture reference books studied had a mean readability appropriate for students of average reading ability in one of the four high school grade levels, but in general the texts tended to be too difficult for the ability of the students who used them. Ruth (1962) surveyed the Career Information Kit Supplement of the SRA Occupations File and found readability levels ranging from grade 9 to grade 16 with a mean of 14.7, and that SRA-prepared briefs had greater consistency in readability levels than did items written by other individuals. Ruth concluded that the material was too difficult for secondary students, and Van Vliet (1971) found that students who read occupational information pamphlets at their own grade level were likely to gain more information and make fewer interest changes than students who read pamphlets written above their grade levels. Fields (1973) found that 18 out of 19 vocational texts had readability levels above the reading abilities of 50 to 100 per cent of the students using them.

Other Educational Studies

Ramsey (1962) surveyed seven junior high school texts and found readability levels in six of them to be one year or more below their grade placement; only science had a higher readability placement. Bryant (1971, 1972), however, in finding differences between the reading level of secondary students and the readability of their texts, concluded that more than one-half the students

were assigned books too difficult for their abilities. Cline (1972, 1973) found similar results at the junior college level: 11 out of 17 books were above the reading level of 50 per cent of the students in the class to which the texts were assigned. Janz (1970) and Janz and Smith (1972) found that the majority of English, social studies, and science texts were too hard for students but pointed out (Janz & Smith, 1972) that a one-year difference is "probably not of much practical importance[p. 622]" because of the factors not measured by readability formulas which influence the ease of reading. Grace (1963) found that programmed material tended to be easier than written material because of fewer syllables and shorter, more familiar words. Walker (1966a, 1966b), however, found that 26 out of 39 programmed texts had higher readability levels than publisher estimates, 11 coincided with publisher estimates, and 2 were lower than publisher estimates. Babcock (1971) found that figurative language does not affect the readability of a literary passage, although Galloway (1973) found that content books were easier to read than literature texts. Beard (1967) concluded that the comprehensibility of prose used in government, world history, chemistry, and biology texts was approximately the same.

Readability Studies in Related Areas

Readability studies have been applied in areas other than public education. The level of readability is of concern to both the military and mass media specialists.

The Military

Klare, Mabry, and Gustafson (1955) tested retention of material in an aircraft mechanics training course for newly inducted airmen. They found that materials categorized Easy (grades 7-8) and Present (grades 11-12) resulted in more words read in a given time period than materials categorized Hard (grade 16 and above), and that immediate retention was highest for Easy materials. Siler (1974) attempted to determine the reason why enlisted Coast Guard personnel failed to complete successfully the required correspondence courses; he found the average reading level of subjects was 11.2, and the average readability levels of materials was 13.6. Standlee and Fattu (1956) found that although Navy programs required that enlisted men be able to read at fourth grade level before beginning recruit training, all of eight Navy publications studied ranged from grade 6 through college.

Mass Media: Printed

Kwolek (1973) concluded that women's magazines, general circulation materials, and general agricultural materials were at a level acceptable to most adults. Those below the average adult level included men's magazines, youth magazines, best sellers, and romance, movie, and television literature; those above the average adult level included agricultural yearbooks, great books, technical and trade books and magazines, scientific journals, newspapers, instruction manuals, and high school texts. In surveying children's magazines, Groff (1962) found from 0 to

1, 2 year differences between readability levels of two issues of the same magazine 14 months apart. Craig (1953) concluded that most best sellers in the United States were too hard for the average reader to read with understanding and that the ease of reading is a factor in influencing sales. Razik (1969) studied front page and news articles of metropolitan and non-metropolitan newspapers and found the metropolitan newspapers easier to read. In 6 out of 13 news categories, both newspapers wrote articles with the same level of readability; of the remaining 7 categories, the metropolitan reading levels were easier in 5 categories, harder in one category, and had no articles in the last category.

Mass Media: Oral and Visual

Others (Chall, 1958; Chall & Dial, 1948) have analyzed the difficulty of newsscripts on the basis of readability formulas. They found that predictions of readability formulas were good estimates of listening difficulty, although the listening difficulty seemed to be one to two grade levels higher than reading difficulty. They also found that the lower the readability, the more interesting the article is to listeners. Allen (1952) contributed evidence that readability formulas can be used to predict the readability of oral verbal material. By varying the commentary accompanying educational films, he found that the level of the commentary affected the learning of actual content, although he questioned how much the film's visuals affected grade level placement.

Summary of the Literature

Manzo (1970) called for a halt to all readability research. He accused researchers of suffering from "tunnel vision" and continued uni-dimensional research, and claimed that readability formulas offered little additional beneficial knowledge beyond what common sense offered. In response, Tibbits (1973) questioned whether it is even possible or desirable for readability formulas to do what its critics claim are its deficiencies. Pauk (1970) rated 44 articles on three different formulas in order to demonstrate that not all readability formulas would rate each passage the same. Jongsma (1972) asked school and public librarians to estimate the grade level of each of 12 Newberry winners. Their mean estimates approximated formula results, seldom differing by as much as one grade level. Jongsma postulated that librarians used an intuitive and subjective assessment of style, vocabulary level, format, content and interest, coupled with an understanding of the interests of young readers. Taylor (1963) and Wood (1954) found that teachers were reasonably accurate in estimating the readability level of elementary grade textbooks; Sprague (1969) found similar results but with less teacher accuracy. Janz and Smith (1972) speculated that because researchers do not take into account factors unmeasured by readability formulas, a difference of only one grade level between students' reading abilities and textbook reading levels may not be of much practical importance. Yoakum (1954) admitted that readability formulas are far from perfect but measure sequences of materials of increasing

difficulty with considerable reliability. Chall (1955) concluded that using a readability formula for estimating relative difficulty is justifiable, but "use of a readability formula for determining the exact grade level of difficulty appears questionable [p. 45]."

Despite the imperfections of readability measures, it is nevertheless necessary to establish some measure of progressive difficulty, particularly in individualized materials designed to teach literacy. Rakes (1972, 1973a, 1973b) conducted a study of numerous materials, including the SRA Reading Laboratory IIIA, used in adult basic education classes. The present study proposes to examine another frequently used literacy material, the SRA Reading Laboratory IIIB.

Chapter III: METHODOLOGY

This chapter describes the methodology, research design, selection of materials and tools used, procedure, and treatment of data in this study. The Dale-Chall formula will be described in some detail, along with problems in its use, and arbitrary decisions made concerning its application.

Description of Methodology

This study is a survey of the power builder components of the SRA Reading Laboratory IIIB. Each power builder was sampled. Two to three passages, one passage for approximately every 500 words from each power builder, were selected. A computer program then calculated the readability level for each passage; the readability analysis was then refined by hand. Readability averages for each power builder and for each color level were then derived.

Research Design

This study is designed as a survey; more specifically, as a census of tangibles. It yields a readability level for each power builder surveyed and an average readability level for all power builders grouped in one color level.

Selection of Materials

For the purposes of this survey, the SRA Reading Laboratory IIIB (Science Research Associates, 1963) was selected. The Reading Laboratory consists of two major components, the power builders and the rate builders. Each component is arranged into nine groups of successive difficulty. Each group, identified by a

different color, contains 16 cards of equal difficulty. Grade levels range from 5.0 to 12.0. Also included in the Reading Laboratory are listening skill builders and listening-notetaking skill builders.

The power builder unit was selected for evaluation in this study. Each power builder consists of a reading selection of approximately 800-1750 words, depending on the level of difficulty. Following the reading selection are two sets of questions. "How Well Did You Read" is a comprehension check and evaluates the ability to gather information, make inferences, and evaluate critically. "Learn About Words" develops vocabulary and word study skills. Only the reading passage was evaluated for readability.

Instrumentation

Selection of the Readability Scale

The Dale-Chall readability formula (Dale & Chall, 1948a, 1948b) was the tool used to measure readability. The strength of this formula is that it evaluates vocabulary load as well as sentence length. Chall (1958) asserted that of the four types of stylistic elements, vocabulary load was more related to difficulty than sentence structure, idea density, or human interest. Of the two components of vocabulary load, vocabulary difficulty was more related than vocabulary diversity. Klare (1963) cited additional evidence to support this claim. He found that of the 20 to 23 elements isolated as important in readability study, nearly all could be grouped under two main factors: word difficulty and sentence difficulty. Of the two groups, word difficulty was more

important than sentence difficulty. Others (Klare, 1952; Koenke, 1971; Nyman, Kearl, & Powers, 1961; Powers, Sumner, & Kearl, 1958) concur that the Dale-Chall formula is one of the best available.

Description of the Dale-Chall Formula

The Dale-Chall formula is based on the average sentence length and the percentage of unfamiliar words (i.e., percentage of words outside the Dale list). The total number of words in the passage, the number of sentences, and the number of unfamiliar words are counted. The following formula gives an algebraic representation of the formula:

$$x = (.1579)(x_1) + (.0496)(x_2) + 3.6365$$

where

x = readability level

x_1 = Dale score = $\left(\frac{\text{number of words not on Dale list}}{\text{number of words in sample}}\right)(100)$

x_2 = average sentence length = $\frac{\text{number of words in sample}}{\text{number of sentences in sample}}$

Dale and Chall give more specific rules plus a list of 3000 words considered familiar to students in the fourth grade (Dale & Chall, 1948b).

Problems and Arbitrary Decisions in Application of the Dale-Chall Formula

Proper Names. The formula rules specify that a compound name of a person or a place counts as one word and that the name of a person or a place is a familiar term. Examples are le Brun and Van Buren. To be consistent, it was decided to treat as a compound

name (and thus as one word) proper names which are comprised of two or more words. Thus, New York and St. Louis were considered as one word each, while Mississippi River, New York City, and Lake Erie were considered two words each.

Names of persons are considered familiar, but the authors do not indicate if this is true for specific individuals or for groups of individuals as well. It was decided to consider as familiar proper names, whether adjective or noun, which refers to groups of individuals. Thus, Aztecs and Egyptians were familiar. The phrase Aztec buildings was two familiar words, even though Aztec does not appear on the Dale list, and the phrase Egyptian people was considered as two familiar words, even though more than an n is added to Egypt. However, terms such as Republican, Catholic, the Allies, Southerners, and Communists were not considered familiar.

Words of Multiple Meanings. The Dale list usually specifies as familiar only base words, although certain specified endings can be added and still be considered familiar. The authors do not specify which meaning, or as what part of speech, a given word is considered familiar. To be consistent, it was decided to accept as familiar all approved variants of a word regardless of its meaning or part of speech. Thus, troubled, whether it was used as an adjective or as a verb, was considered familiar. Similarly, since barked as a past tense verb is familiar, then rough-barked tree was also familiar.

Punctuation. The computer program was written so that no form of punctuation, except the period, was read. This offered two main advantages. First, data could be keypunched more quickly

since fewer characters had to be punched. Second, since the computer did not read apostrophes and did not distinguish between upper and lower case letters, one entry in the computer dictionary sufficed for two different words in text. Thus, aunts was entered into the dictionary but indicated either possessive or plural; ill indicated either I'll or ill; and am indicated either am or A.M. A few situations--e.g., won't-wont, can't-cant--required correction by hand.

Abbreviations and Symbols. With certain exceptions, abbreviations are considered unfamiliar. For example, Mr. and Mrs. are considered familiar because they appear on the Dale list, and abbreviations of the months are considered familiar because the names of the months are on the word list. Therefore, Dr. and abbreviations of the days of the week were also considered familiar. Etc. and TV were considered unfamiliar because et cetera and television were not on the list.

The symbols $ and ¢ were considered familiar because dollar(s) and cent(s) are on the Dale list; each symbol was counted as one word. The symbol % was considered one word but unfamiliar because percent is not on the list.

Letters and Numbers. Because numbers are considered familiar and one word, letters of the alphabet in isolation were also considered familiar and one word. Thus, the consonant T was two familiar words (the, T) and one unfamiliar word (consonant); B24 was considered one familiar word.

Whenever a number was encountered in text, the familiar

word number was substituted. By eliminating the need to add each number to the dictionary, computer memory was saved because no storage was required for infrequently used entries, and time was saved in preparing the passage for computer analysis. Thus, January 6, 1954 was submitted to the computer as January date date; January 6th was treated as January number; and the sixteenth division was keypunched as the number division.

Procedure

One passage for approximately every 500 words was selected for study. No passage began or ended in the middle of a sentence. Passages were evenly spaced throughout the selection. An initial computer analysis for each passage was made and then refined by hand evaluation. An average readability score for each power builder was then determined. Similarly, a readability average for each color level was then derived.

Treatment of Data

Computer facilities were used courtesy of the University of Texas at Houston Education and Research Computer Center. The computer program, included in the Appendices, was developed by Isaac Rosen. The program is supplemented by a dictionary containing words appearing on the Dale list and acceptable variants of words on the Dale list.

Chapter IV: FINDINGS OF THE RESEARCH

The purpose of this study was to evaluate the readability levels of the power builder component of the SRA Reading Laboratory IIIB. Results of the research are presented in Tables 1-3. In order to determine the progressive levels of difficulty, readability levels presented in the tables are interpolated from the raw scores and corrected grade levels of the Dale-Chall formula and are then rounded off to the nearest decimal.

Question 1

Question 1 asked, "What is the Dale-Chall readability level of each power builder in the SRA Reading Laboratory IIIB?" The readability scores for the power builders range from grade 4.0 to grade 13.9. The findings of the research are presented in Table 1.

Question 2

Question 2 asked, "What is the average Dale-Chall readability level of each color level within the SRA Reading Laboratory IIIB?" The average readability score for each level ranges from grade 5.8 to grade 12.2. The findings of the research are presented in Table 2.

Question 3

Question 3 asked, "Do the readability levels for each color level correspond to the readability level asserted by the publisher?" The average Dale-Chall readability score for all levels is .2 to 1.4 years higher than the publisher-determined grade level. The findings of the research are presented in Table 3.

Table 1

Dale-Chall Readability Scores:
Individual Power Builders

	Card	Readability Scores		
		Sample 1	Sample 2	Average
Blue	1	4.0	4.0	4.0
	2	5.6	6.8	6.2
	3	5.4	5.7	5.6
	4	4.0	4.0	4.0
	5	5.8	5.6	5.7
	6	5.9	5.2	5.6
	7	4.0	5.5	4.8
	8	[illegible]3	5.1	6.2
	9	8.2	9.8	9.0
	10	7.9	7.5	7.7
	11	6.8	5.3	6.0
	12	8.4	6.5	7.4
	13	4.0	6.7	5.4
	14	5.3	5.7	5.5
	15	4.0	4.0	4.0
	16	5.2	6.3	5.8
Rose	1	4.0	5.4	4.7
	2	5.5	5.2	5.4
	3	7.0	5.3	6.2
	4	8.1	8.6	8.4
	5	6.8	6.8	6.8
	6	6.6	6.9	6.8
	7	6.0	6.7	6.4
	8	6.8	7.0	6.9
	9	9.8	5.9	7.8
	10	6.0	7.5	6.8
	11	7.0	5.6	6.3
	12	5.2	9.3	7.2
	13	4.0	4.0	4.0
	14	7.0	8.4	7.7
	15	8.9	6.3	7.6
	16	9.5	6.6	8.0
Brown	1	6.4	7.0	6.7
	2	5.6	6.1	5.8
	3	7.8	10.0	8.9
	4	6.6	8.8	7.7
	5	11.6	7.6	9.6
	6	10.6	8.0	9.3
	7	6.9	4.0	5.4
	8	8.2	6.1	7.2
	9	4.0	6.4	5.2
	10	5.7	7.8	6.8

	Card	Readability Scores		
		Sample 1	Sample 2	Average
Brown	11	6.9	8.9	7.9
	12	4.0	6.7	5.4
	13	6.7	7.4	7.0
	14	5.7	8.7	7.2
	15	5.7	5.3	5.5
	16	4.0	6.1	5.0
Green	1	7.0	8.0	7.5
	2	9.2	9.3	9.2
	3	7.4	9.3	8.4
	4	7.9	6.4	7.2
	5	7.2	5.6	6.4
	6	6.7	7.7	7.2
	7	5.8	5.8	5.8
	8	11.3	8.2	9.8
	9	10.3	7.4	8.8
	10	6.1	9.6	7.8
	11	7.4	7.8	7.6
	12	9.2	8.8	9.0
	13	15.1	7.7	11.4
	14	7.2	8.3	7.8
	15	10.8	9.1	10.0
	16	7.1	6.9	7.0
Red	1	9.0	10.1	9.6
	2	10.5	8.0	9.2
	3	10.5	8.2	9.4
	4	9.0	11.0	10.0
	5	7.3	10.5	8.9
	6	9.4	8.7	9.0
	7	11.5	10.1	10.8
	8	7.2	7.9	7.6
	9	10.7	10.4	10.6
	10	7.2	6.8	7.0
	11	9.2	9.7	9.4
	12	11.1	9.7	10.4
	13	7.5	6.7	7.1
	14	8.2	9.0	8.6
	15	6.9	8.6	7.8
	16	8.4	9.7	9.0

	Card	Readability Scores			
		Sample 1	Sample 2	Sample 3	Average
Tan	1	11.2	9.2	10.3	10.2
	2	7.6	8.8	7.7	8.0
	3	9.2	7.4	8.0	8.2
	4	9.1	11.7	9.1	10.0
	5	10.9	10.7	8.3	10.0
	6	8.9	8.7	7.4	8.3
	7	9.8	9.7	8.9	9.5
	8	8.4	10.6	10.5	9.8
	9	11.4	12.0	11.0	11.5
	10	9.2	9.3	11.4	10.0
	11	6.1	8.2	8.3	7.5
	12	10.9	9.6	9.8	10.1
	13	8.9	7.4	8.1	8.1
	14	7.6	9.1	8.7	8.5
	15	9.6	7.6	7.2	8.1
	16	14.3	11.8	10.7	12.3
Gold	1	11.3	14.0	7.6	11.0
	2	8.5	8.5	8.4	8.5
	3	8.8	9.8	9.9	9.5
	4	8.7	10.7	10.1	9.8
	5	12.7	8.6	11.5	10.9
	6	10.0	10.4	11.7	10.7
	7	10.6	10.6	11.1	10.8
	8	12.4	9.7	15.9	12.7
	9	10.1	9.4	10.9	10.1
	10	12.1	11.0	12.0	11.7
	11	10.4	10.2	9.8	10.1
	12	12.8	12.0	10.0	11.6
	13	12.9	10.5	11.9	11.8
	14	10.2	15.5	11.8	12.5
	15	10.5	9.6	10.2	10.1
	16	9.2	8.4	11.2	9.6
Aqua	1	11.7	10.2	12.4	11.4
	2	10.8	11.3	12.6	11.6
	3	15.2	12.5	11.2	13.0
	4	13.1	15.1	13.6	13.9
	5	11.3	11.6	12.0	11.6
	6	12.8	15.4	12.0	13.4
	7	8.8	5.6	7.9	7.4
	8	14.4	12.9	10.7	12.7
	9	9.8	10.8	7.9	9.5
	10	12.0	13.4	15.0	13.5
	11	12.0	9.4	9.7	10.4
	12	13.3	12.4	8.2	11.3
	13	12.9	11.4	16.0	13.4
	14	9.2	11.7	11.4	10.8
	15	13.6	12.4	10.0	12.0
	16	9.9	11.1	11.4	10.8

	Card	Readability Scores			
		Sample 1	Sample 2	Sample 3	Average
Purple	1	16.0	11.5	12.6	13.4
	2	11.2	11.3	7.6	10.0
	3	11.0	12.6	12.8	12.1
	4	16.0	11.5	12.0	13.2
	5	14.3	12.4	11.6	12.8
	6	11.4	12.3	14.0	12.6
	7	15.5	11.3	12.4	13.1
	8	12.2	10.5	15.0	12.6
	9	12.0	13.6	7.5	11.0
	10	9.5	11.8	11.3	10.9
	11	12.7	12.3	8.5	11.2
	12	11.0	12.8	11.9	11.9
	13	9.9	15.4	12.6	12.6
	14	14.5	10.1	11.1	11.9
	15	11.7	10.4	15.7	12.6
	16	12.4	14.0	12.0	12.8

Table 2

Dale-Chall Readability Scores:
Power Builder Color Levels

Color	Readability Score (average)	Readability Range
Blue	5.8	4.0- 9.0
Rose	6.7	4.0- 8.4
Brown	6.9	5.0- 9.6
Green	8.2	5.8-11.4
Red	9.0	7.0-10.8
Tan	9.4	7.5-12.3
Gold	10.7	8.5-12.7
Aqua	11.7	7.4-13.9
Purple	12.2	10.0-13.4

Table 3

Publisher-Determined Grade Levels
and Dale-Chall Readability Scores

Color	Publisher-Determined Grade Levels	Dale-Chall Readability Scores	Difference
Blue	5.0	5.8	+ .8
Rose	5.5	6.7	+1.2
Brown	6.0	6.9	+ .9
Green	7.0	8.2	+1.2
Red	8.0	9.0	+1.0
Tan	9.0	9.4	+ .4
Gold	10.0	10.7	+ .7
Aqua	11.0	11.7	+ .7
Purple	12.0	12.2	+ .2

Chapter V: DISCUSSION OF INFORMATION

Conclusions

The research findings indicate that at no level does the Dale-Chall readability average correspond to the grade level asserted by the publisher. However, if one considers the publisher-determined grade level as a grade level range, then five of nine Dale-Chall readability averages (brown, tan, gold, aqua, purple) do correspond to the publisher grade level. For example, if one considers the grade level of tan as 9.0-9.9 rather than 9.0, then the Dale-Chall readability score of 9.4 does indeed correspond to the publisher estimate. This view of the publisher-determined grade level is warranted since it is unrealistic to assume that all sixteen cards in any one level would be written at exactly the grade level specified. This view is supported by Chall's statement (1955) that a readability score at best gives a comparative rather than an absolute measure of difficulty.

Despite this approach, the readability scores in any one level cover a wide range. The smallest range occurs in purple--3.4 years. The highest readability score for an individual card in that level is 1.4 years above the publisher-determined grade level; the lowest, 2 years below. The largest range occurs in aqua--6.5 years. The highest readability score for an individual card in that level is 3.0 years above the publisher-determined grade level; the lowest, 3.6 years below.

The results of this study indicate that the publisher-determined grade level does not guarantee that any one card in a

given grade level is written at that readability level, or even nearly so. Neither do the results suggest that the readability average of the level approximates the grade level determined by the publisher. If SRA has indeed used a readability measurement, the results of such measurement have been tempered by other considerations to the extent that such measurement is at best questionable. In an era of innumerable functional illiterates and below-average readers, it is unfortunate that promoters of literacy do not reveal more readily and more openly the criteria by which they measure the difficulty of their materials.

Recommendations

Application of Research Findings

It would benefit educators if Science Research Associates did one or more of the following:

1) Change the grade level to indicate a grade level range rather than a specific grade level.
2) Regroup the power builders so that all cards fall within the range of the level.
3) Within each level, arrange the power builders by difficulty so that all 144 power builders are arranged in an order of progressive difficulty.
4) Publish the readability score for each power builder and identify the standard of measurement used.
5) If the publisher feels a particular power builder is better suited to a grade level other than that indicated by the readability measurement, the change should be

so indicated. Such decisions should be based on the results of field research rather than on an editor's subjective judgment.

6) Use a multi-code system of identification to signify readability level, interest level, and content appeal. SRA uses similar systems of identification in its Dimensions in Reading and Vocabulab III reading kits.

7) Institute an organizational system whereby each level slightly overlaps the level immediately before and immediately following. SRA uses such a system in its Pilot Library IIIA.

Revision of the Dale-Chall Formula

Because the problems in using the Dale-Chall formula necessitate arbitrary decisions, it is likely that different researchers will arrive at different readability levels for the same passage. As indicated in Chapter III, the following problems need attention:

1) Proper names comprised of two or more words
2) Proper names referring to groups and to individuals, as adjectives and as nouns
3) Words with multiple meanings
4) Words which can be used as more than one part of speech
5) Abbreviations and symbols for words on the Dale list
6) Letters of the alphabet in isolation
7) Use of ordinal numbers and Roman numerals
8) Revisions and additions to update the Dale list

Further Research

Numerous research studies have indicated that publishers of textbooks in all areas of academic, industrial and vocational education have inaccurately estimated the difficulty of the textbooks. With the notable exception of Rakes (1972, 1973a, 1973b), surprisingly few studies have been conducted in non-textbook materials for teaching literacy. It is strongly suggested that more research be conducted in this area to determine the readability levels for frequently used literacy materials. This research should be conducted for its inherent and utilitarian values, and as an effort by educators to encourage publishers to state more openly and more readily the criteria by which they evaluate the difficulty of their materials. Teachers will then be better equipped to assess the accuracy of publisher estimates as well as publisher promises for success.

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SRA SCIENCE RESEARCH ASSOCIATES, INC.
A Subsidiary of IBM

259 East Erie Street
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Cable SCIRESUS, Chicago

July 9, 1974

Mrs. Ellen Rosen
Las Virgenes Unified School District
28545 West Driver Avenue
Agoura, California 91301

Dear Mrs. Rosen:

Your letter of July 2 to Dr. Parker has been forwarded to me for reply. You are quite right that the teachers' handbooks for the Reading Laboratories have been generally silent on the subject of how reading levels are determined. Various users have asked this question over the years however, so in the 1973 revision of the 1a, 1b, and 1c labs we decided to include a discussion of this very point (see enclosed photocopy).

As a reading coordinator you are of course familiar with such readability measures as the Fry formula, the Spache formula, the Flesch formula, and the Dale-Chall formula. SRA's editors employ a formulaic measure of this sort to establish an overall objective framework for each color level, and within that framework they manipulate judgmental matters that will further suit the materials to the experience, maturity, and linguistic sophistication of the intended audience.

We appreciate your writing to us and trust that this reply will fill the gap left by our teachers' handbooks. It is by responding to the comments and queries of persons like yourself that we learn how to improve our products and how to explain them more effectively.

Cordially yours,

George R. Paterson
Senior Editor
Language Arts

GRP:nie

Enclosure

```
      PROGRAM DALE(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,
     *TAPE8,TAPE9)
      COMMON WORD(300,2),UFAM(300,2),FAM(300,2),
     *DICT10(8000),DICT20(200,2)
      COMMON/ICOUNT/NSEN,NOU,NOF,NTOT,IFLAG,IDENT1,IDENT2
      INTEGER WORD,UFAM,FAM,DICT10,DICT20
    1 FORMAT(R6,3X,2A10)
    2 FORMAT(4(2X,2A10))
   30 FORMAT(///,5X,34HTHE NUMBER OF UNFAMILIAR WORDS IS ,
     *I3,/)
   40 FORMAT(/,5X,32HTHE NUMBER OF FAMILIAR WORDS IS ,I3,/)
   50 FORMAT(1H1,4X,43HTHE TOTAL NUMBER OF WORDS IN THE
     *SAMPLE IS ,I3)
   60 FORMAT(/,5X,47HTHE TOTAL NUMBER OF SENTENCES IN THE
     *SAMPLE IS ,I3)
  110 FORMAT(/,5X,24HAVERAGE SENTENCE LENGTH=,F10.3)
  120 FORMAT(/,5X,18HFORMULA RAW SCORE=,F10.3)
  300 FORMAT(/,5X,12HDALE SCORE= ,F6.2)
  400 FORMAT(/,5X,18HDC CORRECTED GRADE,5X,A5)
  500 FORMAT(///,1X,17HNO. OF UNFAMILIAR,6X,11HFORMULA RAW,
     *8X,12HDC CORRECTED,6X,12HINTERPOLATED,/,7X,5HWORDS,
     *16X,5HSCORE,15X,5HGRADE,10X,11HGRADE LEVEL)
  501 FORMAT(8X,I3,18X,F4.1,16X,A5,12X,F4.1)
  700 FORMAT(/,5X,24HINTERPOLATED GRADE LEVEL,5X,F4.1)
C
C     DISPLAY CODE 57 = .
C     DISPLAY CODE 55 = BLANK
C     DISPLAY CODE 01 TO 32 = A TO Z
C     DISPLAY CODE 33 TO 44 = 0 TO 9
C     NOF=NUMBER OF FAMILIAR WORDS
C     NOU=NUMBER OF UNFAMILIAR WORDS
C     NTOT=TOTAL NUMBER OF WORDS IN SAMPLE.
C     NSEN=TOTAL NUMBER OF SENTENCES IN SAMPLE.
C     SENAV=AVERAGE SENTENCE LENGTH.
C     DSCOR=DALE SCORE.
C     FRS=FORMULA RAW SCORE.
C     GRADE=GRADE LEVEL
C
      CALL COMP(0)
      IFLAG=0
   80 M=0
  600 READ(5,1) INST,IDENT1,IDENT2
      IF(INST.EQ.6HGRADE ) M=1
      IF(INST.EQ.6HADD   ) M=2
      IF(INST.EQ.6HDELETE) M=3
      IF(INST.EQ.6HLIST  ) M=4
      IF(INST.EQ.6HGRADEA) M=5
      IF(INST.EQ.6HSTOP  ) GO TO 20
      IF(M.EQ.0) GO TO 600
      CALL INPT(M)
```

```
      IF(M.NE.1) GO TO 80
      WRITE(6,30) NOU
      IF(NOU.NE.0) WRITE(6,2) ((UFAM(J,K),K=1,2),J=1,NOU)
      WRITE(6,40) NOF
      IF(NOF.NE.0) WRITE(6,2) ((FAM(J,K),K=1,2),J=1,NOF)
      FTOT=FLOAT(NTOT)
      SENAV=FTOT/FLOAT(NSEN)
      DSCOR=FLOAT(NOU)/FTOT*100.
      FR=SENAV*.0406+3.6365
      FRS=FR+DSCOR*.1579
      CALL LEVEL(FRS,GRADE,GRLEV)
C
C     OUTPUT
C
      WRITE(6,50) NTOT
      WRITE(6,60) NSEN
      WRITE(6,110) SENAV
      WRITE(6,300) DSCOR
      WRITE(6,120) FRS
      WRITE(6,400) GRLEV
      WRITE(6,700) GRADE
      WRITE(6,500)
      MOU=NOU+1
      DO 70 L=1,MOU
      NU=L-1
      DSC=FLOAT(NU)/FTOT*100.
      FRSP=FR+DSC*.1579
      CALL LEVEL(FRSP,GRADE,GRLEV)
      WRITE(6,501) NU, FRSP, GRLEV, GRADE
   70 CONTINUE
      GO TO 80
   20 IF(IFLAG.EQ.1) CALL COMP(6)
      END
```

```
      SUBROUTINE LEVEL(FRS,GRADE,GRLEV)
      GRLEV=5H0-4
      IF(FRS.GE.5.0) GRLEV=5H5-6
      IF(FRS.GE.6.0) GRLEV=5H7-8
      IF(FRS.GE.7.0) GRLEV=5H9-10
      IF(FRS.GE.8.0) GRLEV=5H11-12
      IF(FRS.GE.9.0) GRLEV=5H13-15
      IF(FRS.GE.10.0) GRLEV=5H16+
      GRADE=4.0
      IF(FRS.GE.5.0) GRADE=2.0*FRS-5.0
      IF(FRS.GE.9.0) GRADE=3.0*FRS-14.0
      IF(FRS.GE.10.0) GRADE=16.0
      END
```

```
      SUBROUTINE INPT(INDEX)
      DIMENSION INA(80)
      INTEGER WORD,B1,   B3,B4,B5
      COMMON WORD(300,2)
      COMMON/ICOUNT/NSEN,NOU,NOF,NTOT,JUMP,IDENT1,IDENT2
    1 FORMAT(80R1)
   20 FORMAT(1X,80R1)
   30 FORMAT(//,4(2X,2A10))
  401 FORMAT(1H1,1X,2A10,//,28X,15HSAMPLE ANALYSIS,/)
  501 FORMAT(1H1,20X,24HWORDS ADDED TO DALE LIST)
  601 FORMAT(1H1,10X,26HWORDS DELETED FROM DALE LIST)
      JFLAG=0
      B1=000000000000000000558
      B3=000000000000000000006
      B4=000000000000000000578
      B5=000000000000000000328
      IF(INDEX.EQ.4) GO TO 400
C
C     INITIALIZE ARRAY WORD(I,J) TO 0.
C
      DO 44 N1=1,300
      DO 44 N2=1,2
      WORD(N1,N2)=B3
   44 CONTINUE
      J=1
      K=1
      L=1
      NSEN=0
      IF(INDEX.EQ.1) WRITE(6,401) IDENT1,IDENT2
      IF(INDEX.EQ.5) WRITE(6,401) IDENT1,IDENT2
C
C     INPUT DATA AS INDIVIDUAL LETTERS AND CONSTRUCT WORDS.
C     COUNT THE NUMBER OF WORDS AND SENTENCES.
C     J=WORD INDEX
C     K= WORD SIZE INDEX
C
   10 READ(5,1) (INA(I),I=1,80)
      IF(INDEX.EQ.1) WRITE(6,20) (INA(I),I=1,80)
      IF(INDEX.EQ.5) WRITE(6,20) (INA(I),I=1,80)
      DO 2 I=1,80
      IF(INA(I).NE.B4) GO TO 8
      NSEN=NSEN+1
      IF(INDEX.EQ.5.AND.J.GE.100) JFLAG=1
      GO TO 2
    8 IF(INA(I).EQ.B1) GO TO 4
      IF(INA(I).GT.B5) GO TO 2
      WORD(J,K)=WORD(J,K)*100B+INA(I)
      IF(L.EQ.10) GO TO 3
      L=L+1
      GO TO 2
    3 L=1
```

```
      K=K+1
      GO TO 2
    4 IEX=10-L+1
      DO 15 M=1,IEX
      WORD(J,K)=WORD(J,K)*(100B)
   15 CONTINUE
      IF(WORD(J,1).EQ.B3) GO TO 5
      IF(JFLAG.EQ.1) GO TO 7
      J=J+1
      K=1
      L=1
    2 CONTINUE
      IF(J.EQ.300) GO TO 5
      GO TO 10
    5 NTOT=J-1
      GO TO 6
    7 NTOT=J
C
C     ALPHABETIZE THE INPUT WORD LIST
C
    6 NT=0
      DO 50 I=1,299
      IF(WORD(I+1,1).EQ.B3) GO TO 60
      IF(WORD(I,1)-WORD(I+1,1)) 50,300,200
  300 IF(WORD(I,2)-WORD(I+1,2)) 50,50,200
  200 NT=NT+1
      DO 100 J=1,2
      IA=WORD(I,J)
      WORD(I,J)=WORD(I+1,J)
      WORD(I+1,J)=IA
  100 CONTINUE
   50 CONTINUE
   60 IF(NT.NE.0) GO TO 6
      GO TO (400,500,600,400,700), INDEX
  500 WRITE(6,501)
      WRITE(6,30) ((WORD(I,M),M=1,2),I=1,NTOT)
      GO TO 400
  600 WRITE(6,601)
      WRITE(6,30) ((WORD(I,M),M=1,2),I=1,NTOT)
      GO TO 400
  700 INDEX=1
  400 CALL COMP(INDEX)
      END
```

```
      SUBROUTINE COMP(INDEX)
      COMMON WORD(300,2),UFAM(300,2),FAM(300,2),
     *DICT10(800),DICT20(200,2)
      COMMON/ICOUNT/NSEN,NOU,NOF,IDLM,IFLAG
      INTEGER SIZE10,SIZE20,B3,UFAM,FAM,WORD,DICT10,DICT20
    1 FORMAT(2I5)
    3 FORMAT(40A2)
   57 FORMAT(1X,18HERROR - THE WORD $,2A10,
     *24H$ IS ALREADY IN THE LIST)
   71 FORMAT(1X,18HERROR - THE WORD $,A10,
     *24H$ IS ALREADY IN THE LIST)
  101 FORMAT(/,1X,18HERROR - THE WORD $,2A10,
     *20H$ IS NOT IN THE LIST)
  121 FORMAT(/,1X,18HERROR - THE WORD $,A10,
     *20H$ IS NOT IN THE LIST)
  301 FORMAT(///,1X,23H10 LETTER LIST, SIZE = ,I5)
  302 FORMAT(/,8(1X,A10))
  303 FORMAT(//,1X,23H20 LETTER LIST, SIZE = ,I5)
  305 FORMAT(/,4(1X,2A10))
  310 FORMAT(1H1,40X,15HDICTIONARY LIST)
      B3=000000000000000000B
      IF(INDEX.EQ.0) GO TO 10
      IF(INDEX.EQ.4) GO TO 500
      IF(INDEX.EQ.6) GO TO 300
      IF(INDEX.EQ.2) IFLAG=1
      IF(INDEX.EQ.3) IFLAG=1
C
C     INDEX=1, COUNT FAMILIAR AND UNFAMILIAR WORDS
C     INDEX=2, ADD NEW WORDS TO THE DICTIONARY LIST
C     INDEX=3, DELETE WORDS FROM THE DICTIONARY LIST
C
      NOU=0
      NOF=0
       DO 21 I=1,300
      IF(WORD(I,1).EQ.B3) GO TO 400
      IF(WORD(I,2).EQ.B3) GO TO 50
C
C      20 LETTER WORDS
C
      DO 43 J=1,SIZE20
      IF(WORD(I,1)-DICT20(J,1)) 44,45,43
   45 IF(WORD(I,2)-DICT20(J,2)) 44,47,43
   43 CONTINUE
      IF(INDEX.EQ.1) GO TO 11
      IF(INDEX.EQ.3) GO TO 100
C
C      ADD NEW WORD TO END OF LIST
C
      SIZE20=SIZE20+1
      DO 42 N=1,2
```

```
      DICT20(SIZE20,N)=WORD(I,N)
   42 CONTINUE
      GO TO 21
   44 IF(INDEX.EQ.1) GO TO 11
      IF(INDEX.EQ.3) GO TO 100
C
C      ADD NEW WORD TO INTERIOR OF LIST
C
      SIZE20=SIZE20+1
      K=SIZE20-J
      DO 46 L=1,K
      M=SIZE20-L
      DO 51 N=1,2
      DICT20(M+1,N)=DICT20(M,N)
   51 CONTINUE
   46 CONTINUE
      DO 52 N=1,2
      DICT20(J,N)=WORD(I,N)
   52 CONTINUE
      GO TO 21
   47 IF(INDEX.EQ.1) GO TO 16
      IF(INDEX.EQ.3) GO TO 110
C
C      NEW WORD ALREADY IN DICTIONARY
C
      WRITE(6,57) (WORD(I,K),K=1,2)
      GO TO 21
  100 WRITE(6,101) (WORD(I,K1),K1=1,2)
      GO TO 21
C
C     DELETE WORD
C
  110 SIZE20=SIZE20-1
      DO 111 L=J,SIZE20
      DO 111 N=1,2
  111 DICT20(L,N)=DICT20(L+1,N)
      GO TO 21
C
C      10 LETTER WORDS
C
   50 JPP=1
      DO 600 JP=1,SIZE10,100
      IF(WORD(I,1)-DICT10(JP)) 650,650,610
  610 JPP=JP
  600 CONTINUE
  650 DO 60 J=JPP,SIZE10
      IF(WORD(I,1)-DICT10(J)) 61,62,60
```

```
   60 CONTINUE
      IF(INDEX.EQ.1) GO TO 11
      IF(INDEX.EQ.3) GO TO 120
C
C       ADD NEW WORD TO END OF LIST
C
      SIZE10=SIZE10+1
      DICT10(SIZE10)=WORD(I,1)
      GO TO 21
   61 IF(INDEX.EQ.1) GO TO 11
      IF(INDEX.EG.3) GO TO 120
C
C       ADD NEW WORD TO INTERIOR OF LIST
C
      SIZE10=SIZE10+1
      K=SIZE10-J
      DO 65 L=1,K
      M=SIZE10-L
      DICT10(M+1)=DICT10(M)
   65 CONTINUE
      DICT10(J)=WORD(I,1)
      GO TO 21
   62 IF(INDEX.EQ.1) GO TO 16
      IF(INDEX.EG.3) GO TO 130
C
C       NEW WORD ALREADY IN DICTIONARY
C
      WRITE(6,71) WORD(I,1)
      GO TO 21
  120 WRITE(6,121) WORD(I,1)
      GO TO 21
C
C       DELETE WORD
C
  130 SIZE10=SIZE10-1
      DO 131 L=J,SIZE10
  131 DICT10(L)=DICT10(L+1)
      GO TO 21
C
C       UNFAMILIAR WORD
C
   11 NOU=NOU+1
      DO 33 N=1,2
      UFAM(NOU,N)=WORD(I,N)
   33 CONTINUE
      GO TO 21
C
```

```
C       FAMILIAR WORD
C
   16 NOF=NOF+1
      DO 12 N=1,2
      FAM(NOF,N)=WORD(I,N)
   12 CONTINUE
   21 CONTINUE
  400 RETURN
C
C
C     INDEX=0, INPUT DICTIONARY LIST
C
   10 READ(8,1) SIZE10,SIZE20
      READ(8,3) (DICT10(I),I=1,SIZE10)
      READ(8,3) ((DICT20(I,J),J=1,2),I=1,SIZE20)
      RETURN
C
C
C     INDEX=4, OUTPUT THE DICTIONARY LIST
C
  500 WRITE(6,310)
      WRITE(6,301) SIZE10
      WRITE(6,302) (DICT10(I),I=1,SIZE10)
      WRITE(6,303) SIZE20
      WRITE(6,305) ((DICT20(I,J),J=1,2),I=1,SIZE20)
      RETURN
C
C
C     WRITE THE NEW DICTIONARY LIST ON THE DISK FILE.
C
  300 WRITE(9,1) SIZE10,SIZE20
      WRITE(9,3) (DICT10(I),I=1,SIZE10)
      WRITE(9,3) ((DICT20(I,J),J=1,2),I=1,SIZE20)
      RETURN
      END
```